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International Institutions and Social Learning in the Management of Global Environmental Risks

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This article investigates the role played by formal international institutions in the broader process of international efforts to respond to and manage global and transboundary environmental risks. Because few international institutions are designed to deal with the broad nature of environmental risks, it focuses on institutional learning. By analyzing the experiences of the United Nations Environment Program, World Meteorological Organization, and other international institutions involved with global warming, this article identifies institutional properties (or functions) that encourage or inhibit social learning in the management of global environmental risks by international institutions, and that influence the adoption of such lessons by their constituent members.

How can governments better deal with global and transboundary environmental risks with irreversible effects that may not be experienced until the future? Conventional wisdom now suggests that more effective management or responses to such risks requires coordinated comprehensive environmental policies that reflect an appreciation of the complexity of global environmental risks, efforts for which functionally differentiated modern states are notoriously poorly equipped. While new policies may ultimately be adopted by states at the national level, in practice, international institutions play a role in harmonizing national efforts and, at times, in educating national officials about new policies and styles of environmental management. In this article we focus on the ways in which formal international institutions have recognized global environmental risks, the ways in which they have developed new techniques for their management, and mechanisms by which such new techniques are disseminated more broadly.

International institutions generally serve as intermediaries in international relations, taking inputs from governments, which in turn are responsive to pressures from other governments and from within their own societies. I treat international institutions as the array of "persistent and connected sets of rules (formal and informal) that prescribe behavioral roles, constrain activity, and shape expectations)" (Keohane, 1989, p. 3). In practice, such institutions generally take the form of more conventional organizations; that is, formal international organizations (IOs). Following Arild Underdal, I differentiate between the conscious and unconscious influence of such organizations on shaping national policies towards addressing transboundary and global environmental risks:

> International organizations can serve at least two major functions in international environmental management: that of being an *arena* for the exchange of information, discussion and decisionmaking, and that of being an *actor* in the policymaking or the policy implementation process. All intergovernmental organizations... serve as arenas...(T)o qualify as *actor,* an organization must (also) provide independent inputs into the policy process, or somehow

amplify the outputs of the process (Underdal, 1993, p. 153; on international/national interplay see also Evans, Jacobson, & Putnam, 1993; Karns & Mingst, 1992; Young, 1991).

This article takes an inductive approach to the study of institutions and social learning by studying a selective but illuminating set of vignettes of new directions pursued by international institutions and lessons learned within the institutions by their constituent members. The origins of innovative ideas are regarded as exogenous; in this chapter we focus on the factors associated with their adoption and diffusion by and through international institutions. I draw conclusions about the significant factors associated with learning by institutions, although we are unable to identify their relative frequency and scope. In these cases international institutions do not make policy, but rather they enhance international dialogues about possible policies, thus leading to the formulation of new policies and their adoption by governments (Linder & Peters, 1995).

I differentiate between the institutional properties that enable organizations to learn; that is to "change...behavior due to a change in perception about how to solve a problem" (E. Haas, 1991, p. 63; also E. Haas, 1990). I also identify some functional activities performed by the institutions that increase the likelihood that institutional innovations will spread, by helping actors identify and apply new techniques for the management of environmental problems as well as contributing to the capacity of such actors to improve their own management.

The article, part of a larger study examining international experience with stratospheric ozone depletion, acid rain, and climate warming, focuses primarily upon international experience with the threat of global climate warming (The Social Learning Group, 2000). It begins with a brief history of institutional involvement with global environmental risks, provides a brief overview of the primary actors involved in the multilateral management of these issues, and then analyzes the application of knowledge to collective management of the climate warming problem.

Institutional Histories

Although concern in the international political community about global environmental risks had previously been awakened, the 1972 United Nations Conference on the Human Environment (UNCHE) was a catalyst in engaging wider interest. Even in the wake of the UNCHE, few of the global risks mentioned here received widespread attention by governments, and most intergovernmental organizations continued to focus on particular environmental problems relevant to their general mandate rather than engaging the full magnitude of such problems. The United Nations Environment Program (UNEP) has been the only international institution with a formal mandate of encouraging action on a wide dimension of environmental risks.

National governments are the primary actors in the management of global environmental risks; however, none of the institutions involved is dominated by a small group of countries, and all, to varying degrees, are open to input from business groups and environmental nongovernmental organizations (NGOs). Business had its heaviest presence at international meetings in the climate change case; this was in part due to the fact that its material interests were most acutely affected in that case—both in terms of potential market gains as well as potential for regulation—and, perhaps, because of growing familiarity and sensitivity to the potential for international regulation, which it had failed to observe in prior

international policy activities (Schmidheiny, 1992). Firms and industry groups have preferred, and achieved their greatest impact by, lobbying their governments directly, although some individuals have enjoyed observer status on national delegations (Faulkner, 1994, p. 231).

Climate Change

Climate change has been addressed by a number of international institutions. The World Meteorological Organization (WMO) began monitoring weather by satellite in the early 1960s. Its World Weather Watch (WWW) was established in 1963 with a mandate to improve the understanding of the physical basis of climate and large-scale weather modification, and to improve weather forecasting. In its operational programs, however, the climate aspect was missing and/or underdeveloped; this reflects the WMO's programmatic focus on shorter-term weather forecasting versus longer-term inadvertent climatological effects of anthropogenic activities (Weiss, 1981, 1983 notes these distinctions in early U.S. and international discussions about climate issues).

The WMO

The WMO convened the World Climate Conference in 1979, following a shift in attention from weather monitoring to climate change by the scientific community stimulated by international concern over the disastrous effects drought had brought to the Sahel region of Africa throughout the previous decade. The World Climate Program (WCP) has collected data and coordinated climate change research at the national level. Most relevant for the study of global environmental risks of the WCP's four components is the World Climate Research Program (WCRP), which is jointly administered by the WMO and the International Council of Scientific Unions (ICSU) and is the successor to Global Atmospheric Research Program (GARP). The WCRP's research focus includes studies of long-term (several decades) responses of climate to natural and anthropogenic influences. The WMO held the Second World Climate Conference (SWCC) in 1990, at which international scientific evidence of climate change was exchanged and examined. By the early 1990s climate and environmental activities accounted for 30% of the WMO's scientific and technical budget and 13.5% of its overall budget, revealing the underlying shift in orientation from weather prediction to climate change (J. Perry, telephone interview, 1993). The World Health Organization (WHO) worked closely with the ICSU in administering its monitoring and research programs, as well as preparing for the first World Climate Conference and the SWCC.

The IPCC

The Intergovernmental Panel on Climate Change (IPCC) was established by the UNEP and the WMO in November 1988, at the behest of national governments, to organize the scientific background, appraise the risks from climate change, and evaluate possible mitigation strategies in preparation for negotiations for a climate change treaty (United Nations General Assembly Resolution 42/184, 1987). The IPCC's approach was dominated by its method of assessing the costs and benefits of the response strategies associated with various emission scenarios. Through 1992 (the period covered in this article) the IPCC was composed of three working groups: scientific analysis, socioeconomic impacts, and policy responses. The IPCC released its first major Assessment Report in August 1990 and a supplement in 1992. The entire effort was steered by a bureau composed of IPCC chairman Bert Bolin, the panel's vice-chairman and

rapporteur, the chairs of the three working groups, and the vice chairs of the working groups (two each from working group (WG) I and II and five from WG III) (Ramakrishna & Young, 1992, p. 256).

Actual negotiations for a climate change treaty were conducted under the auspices of the Intergovernmental Negotiating Committee (INC) for a Framework Convention on Climate Change, established by the UN General Assembly in December 1990 with an autonomous secretariat (United Nations General Assembly Resolution 45/212, 1990). The Climate Change Convention was adopted in June 1992 and entered into force in January 1994.

Epistemic Communities and the Management of Global Environmental Risks

A similar international pattern is evident in the management of climate change, ozone, and acid rain. In each, some effort was undertaken to develop a set of equivalencies between potential environmental threats to human well-being by which risks could be compared and policies formulated. As these approaches were developed under the auspices of international institutions, collective action came to be framed in terms of the new framework and many countries based policy on them. In the climate change case a "tolerable rates" approach was developed to stipulate the degree of potential harm that the global environment could sustain without intolerable social costs.

Collective framing and policy identification in each case was the result of a small transnational network of experts already actively involved in policy-relevant science who gained access to the process through the timely intercession of international institutions. Scientific knowledge was not immediately accessible or apparent to decision makers; it had to be provided by a set of respected advisors. Elsewhere I call these groups "epistemic communities" (P. Haas, 1989, 1990, 1992). Yet the management of global environmental risks occurs within a broader interactive international context in which international institutions adopt and transmit new policy approaches to the national level. For an approach to diffuse broadly it must be institutionally sanctioned. This institutional backdrop confers authority on the views of individuals whose claims would otherwise lack substantial legitimacy.

Climate Change: The Villach Meetings

In the climate change case, the activities of a small group of scientists conferred urgency and focus to discussions that had lacked leadership and focus. The Study of Men's Impact of Climate (SMIC) report was a one-shot study prepared for the UNCHE, but the ICSU was capable of providing the infrastructure for long-term mobilization. A scientific community was first mobilized under the auspices of ICSU's Scientific Committee on Problems of the Environment (SCOPE). The SCOPE had a long-standing interest in global biogeochemical cycles. Scientists in the USSR, many of whom had been students of Vernadsky, had performed much of the relevant research, and SCOPE planners tried hard to include them in SCOPE projects, although few were involved in the seminal SCOPE 29 report that aired in 1985 at Villach, Austria.

In November 1980, as a joint activity of the WCP, SCOPE, the UNEP, and the WMO sponsored a meeting of 11 experts to discuss the role of CO_2 on climate and its impacts. The group reported that CO_2-induced climate change was a major environmental issue, but that, because of scientific uncertainties, it was

premature to promote limits on CO_2 emissions (Kowalok, 1993, p. 35; World Health Organization/United Nations Environment Program/International Council of Scientific Unions, 1980). With the encouragement of the UNEP and principally at the UNEP's expense, the SCOPE Executive Committee authorized a report on the Greenhouse Effect, Climatic Change, and Ecosystems. Interim results were reviewed at Villach in 1983, and the full report was presented at a meeting in Villach from October 9-15,1985. The meeting was held under the auspices of the WCP jointly implemented by the WMO, the UNEP, and the ICSU, and the report was published by the WMO as part of the WCP series of reports on behalf of the other sponsors, giving its conclusions more authority with national governments than would have been the case if it had simply been issued as a SCOPE report. For the first time, the participating experts concluded that "it is now believed that in the first half of the next century a rise of global mean temperature could occur which is greater than any in man's history" and recommended actions that included "support for the analysis of policy and economic options should be increased by governments and funding agencies. In these assessments the widest possible range of social responses aimed at preventing or adapting to climate change should be identified, analyzed and evaluated" (Bolin, Doos, B. R., Jager, J., & Warrick, R. A, 1986, pp. xx, xxxiii; World Meteorological Organization, 1986).

The 1985 Villach meeting emphasized that climate change was likely the consequence of more than just carbon dioxide, and the chair, Jim Bruce of the Canadian Atmospheric Environment Service, pushed the group to endorse the conclusion that it was time to move from research to action by developing risk assessments and response assessments for the issue. It took several years for this message to be articulated in the WMO's climate change-related activities. The heads of the UNEP, the WMO, and the ICSU formed the Advisory Group on Greenhouse Gases (AGGG) in 1986 to advise them on global warming issues. The AGGG was made up of six senior scientists appointed by the heads of the three institutions: Bert Bolin, Ken Hare, G. Golitsyn, S. Manabe, G. Goodman, and M. Kassas (Boehmer-Christiansen, 1993, pp. 377-381). Three working groups were established under the auspices of the AGGG in 1988, with funding from Rockefeller Brothers Fund, Stockholm Environment Institute (SEI) core funds, and the W. Alton Jones Foundation. WG I focused on the analysis of limitation strategies, WG II focused on the indicators of climatic change, and WG III focused on assessments of adaptation and limitation strategies. However, the final AGGG report was not released until 1990, by which time it was overshadowed by the IPCC assessments released that same year (Clark, 1990; Fisher, 1990; Jager, 1990; Rijsberman & Swart, 1990).

The "Villach Group" and Uncertainty

Under the initial auspices of the AGGG, a group of younger scientists coalesced into an active science/policy network. This "Villach Group" organized an additional set of policy-related workshops on a faster timetable. The group was bound together by a common approach toward dealing with uncertainty. While they did not believe that the science was as yet definitive, they believed that more vigorous approaches to understanding and possibly delaying or avoiding climate change was needed. They were comfortable with developing heuristic approaches to understand and manage large complex and uncertain systems, such as the climate system (Bolin et al., 1986; Clark, 1989; Fisher, 1990; Jager, 1990, 1992; Keepin, Mintzer, & Kristoferson, 1986; Oppenheimer, 1989). They were

concerned with maintaining the momentum within international institutions toward policy response that was established at Villach in 1985, which had brought together the core members of the group. A subset of experts attended the major small planning meetings and were involved in the drafting committees of the final statements of the 1988 Toronto Conference and the 1990 SWCC. Contrary to Boehmer-Christiansen's suggestions that the group was principally elitist and motivated by a desire for research funding, interviews and careful readings of their documents suggest that they were concerned and motivated more fundamentally by an abiding desire to address environmental risks they deemed urgent subject to the best scientific and management techniques available to them, which included NGO and citizen participation in the decisionmaking process.

In July 1986 Professor Gordon Goodman of the Beijer Institute Stockholm, together with Michael Oppenheimer of the Environmental Defense Fund (New York, New York) and George Woodwell (Woods Hole Research Center, Woods Hole, Massachusetts) initiated a project to fulfill the policy mandate from the 1985 Villach meeting. The first workshop, held in Villach in September 1987, was attended by about 50 scientists and technical experts who examined how climatic change resulting from increases of greenhouse gas concentrations in the atmosphere could affect various regions of the earth during the next century. The participants also discussed the technical, financial, and institutional options for limiting or adapting to climate change (United Nations Environment Program/World Meteorological Organization, 1988).

To a follow-up workshop in Bellagio, Italy in November 1987, the Villach Group invited a small number of experts believed to be willing to attempt translating science into policy options (Oppenheimer, 1992). The 24 participants used the technical material from the Villach workshop as background material and explored policy steps that might be considered for implementation in the near term and what institutional arrangements would be needed to achieve them. The Villach Group developed the concept of "tolerable rates" of environmental impact at the 1987 Bellagio workshop and proposed a target rate of 0.1 C of temperature change per decade—based on observed historic rates of temperature and sea level change and on expected consequences for ecosystems and societies. While UNEP and WMO representatives expressed interest in using such material in preparation for a climate change treaty modeled possibly on the successful Montreal Ozone Protocol experience, governments drew slightly different conclusions from the process, as discussed below. The spirit of the Villach Group's tolerable rates approach lives on in the United Nations Framework Convention on Climate Change (UNFCCC), although no formal commitments consistent with the approach are elaborated. The objective of "the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" expressed in the UNFCCC also reflects the Villach Group's commitment

> to achieve...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable matter (UNFCCC article 2).

The Villach Group was also instrumental in organizing the 1988 World Conference on the Changing Atmosphere in Toronto, the first international conference on climate change to deliberately include a political perspective (World Meteorological Organization, 1989). The conference, financed by the government of Canada, the UNEP, and the WMO, invited a number of scientists and government leaders in their private roles. The 1988 Toronto conference proposed that governments cut 1988 CO_2 emission levels by 20% by 2005: 10% by conservation and 10% by fuel switching. The 20% figure was a dramatic innovation; up to this point, no national governments had proposed such targets. The proposal emerged from the energy group and was included in the conference declaration by a number of the Villach Group's core members who also served on the drafting committee and who saw the 20% figure as an economically and politically tractable interim step toward the 50% cuts necessary to meet the tolerable rate of 0.1 C warming per decade that had come out of the 1987 Bellagio and Villach workshops.

The Toronto 20% cut target diffused internationally. It was subsequently discussed in Germany, for example. While the 1988 Enquete report preceding the Toronto Conference contained no CO_2 targets, the Enquete report following Toronto, released in 1990, recommended the goal of 30% CO_2 and CH_4 cuts by 2005. Later in 1990 the German government adopted the goal of a 25% CO_2 cut by 2005. The specific Toronto target did not diffuse to become policy in all states. and it was not endorsed by the INC, largely due to the diplomatic efforts of the United States and Organization of Petroleum Exporting Countries (OPEC). However, it did stimulate national government activity regarding climate change. It was a key event in stimulating concern in Canada, and it prompted congressional bills, industry goals, and strategy formulation in the United States.

The Backlash

This successful mobilization of science for global climate change policy precipitated a political backlash. Governments wanted options, not formal recommendations, regarding what they should do. The publicly aired advice tendered by the Villach Group and the Toronto Conference usurped what many government officials felt was their formal role. Governments recognized that unrestrained scientists could press governments for measures they were unwilling to adopt, or for action more quickly than was deemed politically desirable at home. Reflecting on the role of scientists and secretariats in both the ozone and climate change experiences, the U.S. State Department and the Europeans designed new institutions for climate change through which they could better control the political agenda by greater restraint over the use of science in the discussions. A number of experiences contributed to this political suspicion of unconstrained science. The UNEP's ability to designate individual experts was seen by the State Department as a loss of control over the diplomatic process. The Toronto Conference's endorsements of 20% cuts, contrary to U.S. policy wishes, demonstrated to politicians that activist scientists could shame them publicly. Moreover, many of the diplomats from industrialized countries had grown weary of Tolba's strong leadership and hectoring ways (Nitze, 1989, pp. 44-45, 1992; J. Reifsnyder, personal communication, 1992).

The IPCC was formed (via an United Nations General Assembly [UNGA] resolution) as a consequence of the lesson drawn by some national governments that their interests would be better served by exerting direct control over risk and response assessment functions. The UNGA decision was adopted 6 months after

the UNEP's Governing Council had instructed Tolba to consult with the WMO about establishing a coordinative scientific assessment of climate change (United Nations Environment Program, 1987). The UNGA resolution removed from the UNEP and the WMO the authority to designate experts, and firmly lodged the responsibility for drafting a legal document with the governments rather than an international institution. IPCC experts were designated by governments, and the major bureau positions, particularly in WG III on policy, were high-level foreign ministry officials (see Fitzgerald, 1990, pp. 231-250). The Response Strategies WG III, under the chairmanship of the United States, was charged with considering "legal" issues as part of its broader agenda. The United States continually used the IPCC as an instrument to demonstrate the efficacy of U.S. domestic efforts and the absence of any urgency for further action (Barratt-Brown, Hajost, & Sterne, 1993, p. 107; Gray & Rivkin, 1991; Hatch, 1993). The tolerable rates heuristic approach was brought from the Villach Group to IPCC WG III by Pier Vellinga, who served on both bodies. However, the innovation failed to diffuse between the institutions. The IPCC did not develop the concept, as its effects-based logic ran counter to the IPCC's focus on cost-based assessments of strategies. Further, this approach generated stringent emission control scenarios that the United States sought to exclude from consideration. The direct involvement of governments in the IPCC also prevented the UNEP and the WMO secretariats and the Villach Group from driving the international agenda on climate change.

Political Responses to Scientific Framing

Governments were not entirely successful in their effort to divert the political impact of the scientific community. Government designation of scientists appears to have had no noticeable effect on the output of the scientific working groups (I and II) because of the large number of scientists involved, the voluminous background of peer-reviewed scientific literature, the extensive peer review process that was followed, and the large number of nongovernment agency scientists involved (Houghton, Jenkins, & Ephraums, 1990; Tegart, Sheldon, & Griffiths, 1990; World Meteorological Organization/United Nations Environment Program, 1990). Despite governmental reluctance, the 1990 IPCC report did catalyze governmental concern and precipitated the establishment of the INC. The whole enterprise has been met with extensive suspicion from less-developed countries (LDCs), who were incapable of participating in the technical discussions because they lacked the indigenous science to run their own Global Circulation Models (GCMs). Politically, they were distraught that they were unable to extract significant concessions for technology transfer and financing.

The INC itself was formed under UNGA auspices. Again, this distanced the UNEP and the WMO from exerting influence and derailed their fledgling plans to sponsor negotiations (Anderson & Aldhous, 1991, p. 727). Developing states, led by Malta, sought to move the climate negotiations under General Assembly auspices in order to enhance the bargaining position of the South and revive New International Economic Order (NIEO) discussions (A. Borg-Olivier, personal interview conducted by Anilla Cherian, 1992). Environmental NGOs sought to block this move, for fear that it would inject intractable NIEO discussions and make substantive negotiations impossible (Anderson & Aldhous, 1991, p. 727; Nitze, 1992). The United States supported the move to the UNGA as a way of preventing Tolba and the activist UNEP secretariat from exerting entrepreneurial leadership and cajoling laggard states toward a substantive agreement (Nitze, 1992;

Young, 1991). Although the UNEP continued to play a role in the climate convention process, it was never again a leading one.

Science provided the background for what was primarily a political process after 1988. Overriding political concerns about the costs of control overshadowed the influence of science in the INC (Taplin, 1996). Although the 1990 IPCC report was a catalyst in the formation of the INC, a much more powerful magnet for negotiations was the United Nations Conference on Environment and Development (UNCED) timetable. The INC virtually ignored inputs from concurrent risk and response assessments, and most governments' responsiveness to the IPCC declined once negotiations began. The emphasis on political concerns at the expense of scientific input was foreshadowed at the SWCC in late 1990, where the ministerial declaration differed markedly from the more activist scientific declaration on which it was putatively based.

Reprise

Similar results emerged in the cases of climate warming, acidification, and ozone depletion.. Core elements of environmental management were articulated by small transnational networks of scientists. While the existence of these groups preceded the emergence of the issue, their membership was reinforced and tightened through their collective involvement in seeking to develop ways to manage the risks, although networks had more enduring influence in the ozone and acid rain cases than in the climate change case. International institutions helped to legitimate the networks' ideas, consolidate and strengthen the networks, and provide the logistics by which governments actually converted the management concepts into concrete policy measures. The institutions facilitated the persuasion of politicians, as well as supplementing the immediate appeal of the policy concepts with additional institutional incentives. Specific lessons were transmitted by members of these networks whose professional profile and standing attracted attention by institutions.[1] However, the narrow membership of these networks hampered the transmission of lessons between issues and between institutions.[2]

International Institutions and Lesson Drawing

How have international institutions contributed to the management of global environmental risks? How have they contributed to learning about these problems? In this section we look first at changes in the performance of programmatic functions by the institutions relating to the management of global environmental risks, both in terms of initiatives from the institution itself as well as new mandates charged by member governments. We follow with an analysis of the interventions available to international institutions that may improve the capacity of national governments and nonstate actors to cope with environmental risks.

The most striking difference between the cases is the more rapid pace of movement from early scientific warning to international action in ozone than in climate change. In the ozone case it took 4 years from the first scientific warning (publication of the Rowland and Molina hypothesis) to a political international planning meeting (1977 Washington Conference); 8 years until intergovernmental negotiations began; and 14 years until strong international measures (Montreal Protocol). The climate change case was much more protracted. The first scientific warnings appeared in the 19th century. It took 21 years from the renewal of

scientific concern (Keeling's Moana Loa study is representative) to a political international planning meeting (establishment of the INC) and 23 years from first warning until weak international measures (UNFCCC).

Several institutional factors may account for some of this variation. The UNEP's institutional design emphasized its role as a catalyst and did not tie it to a single constituency or single mission, as is the case with the WMO. This enabled the UNEP to be more independent and flexible than the WMO, and thus to recognize and respond to problems in a more rapid manner.

Possibly more important for understanding the variation in institutional impact on overall environmental management across the three issues may be the characteristics of the issues themselves. Climate change was simply a much more intractable political problem, with less scientific certainty, greater anticipated economic costs of suggested responses, and more painful social adjustments asked from citizens of the industrialized countries than in the ozone case. The acid rain case in this regard falls between the ozone and climate change cases, and the involved international organizations guided international responses at a pace that fell between that of the ozone and climate change cases. Consequently, the manipulable variables associated with different institutions and their capabilities for guiding multilateral environmental management may be easier to invoke in cases that are structurally closer to ozone and acid rain than to climate change.

Institutional Learning

The most responsive institutions in which learning occurred were the UNEP and the Villach Group. The WMO experienced some learning, but this was fairly delayed because of the rigid structures through which information to the institution flowed. The INC and IPCC learned very little.

The most common processes by which learning occurred involved the transmission of information to the institution from outside sources. In most cases discussed here this information came from the scientific community because it had the closest established ties to the institutions. In the absence of these ties, major new lessons are likely to be rejected or ignored. There is no reason to believe that other groups—environmental NGOs and business—could not provide valuable new information as well. Learning occurred as new knowledge or understanding was imparted to the institutions and converted into new programmatic activities. In order for an institution to be able to engage in this process it must be able to have timely access to relatively impartial information, be able to effectively process the information internally, and be capable of converting such new ideas into new activities.

Adaptation occurred in institutions without these features. However, potential lessons for dealing with environmental risks that run counter to the wishes of the dominant coalition, or are seriously at odds with major institutional routines, are unlikely to be adopted by such institutions or adapted very gradually. For example, the long gestation involving the WMO's weather to climate shift reflected the persistence of organizational inertia. Adaptation generally occurred for reasons of political expediency; the new ideas were adopted because they corresponded to broader desires of the parties involved, such as the IPCC's move to encourage greater LDC participation and the 30% SO_2 cuts in the acid rain case.

For an institution to respond promptly to new information and to develop new programs it must also be able to act independently of the direct control of member governments. An institution's ability to act independently of the direct control of member governments tends to be a function of a number of factors.

Prior research and conventional wisdom in international relations suggests that at a general level, for international institutions to be able to effectively operate independently of the control of their most influential member governments there must be the absence of fundamental political schisms about world order ideologies among the member governments (E. Haas, 1990). North-South splits often proved insuperable to consensus formation among member governments, although the Cold War did not impede low profile policy coordination on nuclear nonproliferation, limiting atmospheric nuclear radiation from testing atomic weapons, meteorological research, and Antarctica (George, Farley, & Dallin, 1988). The secretariat must have autonomy from governmental hiring choices and some discretion in programmatic choice, as well as possessing sufficient autonomy and technical capacity in order to be able to assimilate new information and actively promote its acceptance and diffusion. The institution must have relatively porous organizational boundaries, which facilitate the flow of information from outside, generally from NGOs and the scientific community. Finally, the executive head must have a management style that is appropriate to the political makeup of the dominant coalition of member countries. Other factors are important as well, such as the utility of the new ideas for satisfying other demands facing the institution.

The UNEP has the strongest institutional capabilities for learning, and repeatedly demonstrated this capacity. It was able to translate new information emanating from the scientific community into effective policy-oriented programs. Its executive heads (Strong 1973-75, Tolba 1976-92, and Dowdeswell 1993-) have been vigorous exponents of environmental protection and research in public, in private with heads of state, and also in private negotiations. They were generally able to effectively cope with disagreements among member states and avoid institutional deadlock. Tolba served as a strong advocate for stringent ozone and climate change targets and cuts during negotiations on the Montreal Protocol and the UNFCCC. Tolba also acted as the developing countries' representative at the meetings, as well as periodically interceding in his own capacity to press for more stringent measures The secretariat is chosen by merit, and actively solicits input from NGOs and the scientific community, who serve on advisory boards, receive funding to provide input into UNEP programs, and are invited in their personal capacity to appear at technical meetings. In contrast with the WMO secretariat, whose recruitment from national meteorological services reinforces WMO's existing perspective, members of the UNEP secretariat are recruited from a broader disciplinary base and often bring lessons with them from other institutions or international policy coordination efforts. This recruitment pattern underlies the UNEP's.

The WMO has been a slow learner. For instance, it took the WMO over a decade to shift its priorities from shorter-term weather issues to longer-term climate concerns. The WMO did undertake some background efforts, but was unable to launch a more vigorous influence on multilateral environmental governance because the WMO faced structural limits to its ability to significantly influence collective environmental management. The WMO has been partially constrained by the constituent meteorological services that control its activities, its status as a specialized agency that has reinforced its weather-oriented mandate and structure, and its betrothal to a single scientific constituency. The WMO heads (Davies 1949-84, Obassi 1984) have played much more reserved roles than UNEP heads, responding to pressures from the G77 on the Executive Council and overseeing a secretariat that was responsive to programmatic expressions of need

by the member governments, but not engaging in the type of proactive, training and educational activities that the UNEP secretariat performed in both ozone and climate change. This role is spurred by the UNEP's organizational mission of catalyst, rather than specialized agency, within the UN system. The provision of new information and scientific initiatives to the WMO filters through the permanent representatives of national governments to the WMO. Thus, the WMO absorbs scientific input primarily through formal and informal consultations with national representatives, following the slow percolation up of information from individual scientists through their national meteorological offices, which act as gatekeepers between national experts and the WMO. The ICSU is closely involved in the administration of many of the WCRP and International Geosphere-Biosphere Program (IGBP) projects (Morel, 1990). The WMO has focused on information related to atmospheric science; it is not porous to knowledge generated in other disciplines. This institutional reliance on a single disciplinary base, stemming from the demands of its core constituency of national weather service chiefs, impairs its ability to rapidly assimilate information about new environmental risks and stimulated the formation of the multidisciplinary IGBP by the ICSU in 1986. While the WMO may well be a good meteorological learner, it is much less adroit at learning about environmental risks.

The INC and the IPCC are hobbled by the limits imposed on secretariat autonomy by member governments. The INC secretariat's responsibilities are highly circumscribed—due to the insistence of China, India, the United States, and the OPEC states—in order to avoid the potential for an independent secretariat that could advance international goal and strategy efforts more aggressively than they desired (Djoghlaf, 1994, p. 104). The small secretariat relies only on governments for data and provides data only to governments. The secretariat cannot exceed these constraints out of fear of antagonizing the developing countries (R. Dolzer, personal interview, March 31, 1994). Although governments are responsible for submitting reports to the secretariat on their emissions and planned reduction policies, their review is to be "facilitative, non-confrontational, open and transparent" (A/AC. 237/46 paragraph 18). Deep North/South political schisms have further hampered the potential for learning.

Control over the IPCC is left entirely up to the member governments serving on the Bureau. Flawed organizational design further inhibited the openness of the IPCC to the transmission of scientific information: IPCC risk assessments and response assessments did not take account of one another's findings as the groups worked in parallel rather than in sequence, so that response policies failed to take much account of evolving risk assessments. This institutional design was deliberately constructed by the U.S. chair of WG3, which sought to influence the results of WG3. Although WG1 and 2 were less directly influenced by state concerns than WG3, they were still disappointing in their lack of responsiveness to innovations elsewhere, or to their ability to disseminate risk and response assessment innovations more broadly.

Further, the IPCC deliberately excluded alternative approaches that based analysis of response options on environmental targets. For instance, the Villach Group's tolerable rates innovation was excluded by IPCC WG3 as a basis for the formation of emission scenarios as its effects-based logic ran counter to the IPCC's cost-based assessment of strategies. Overriding political concerns about the costs of control also precluded the use of science in the INC. The INC virtually ignored inputs from concurrent risk and response assessments, paying no attention to the 1990 scientific declaration of the SWCC or the IPCC's 1992

supplemental appraisal. Once negotiations on the climate change treaty were under way, governmental responsiveness to the IPCC declined.

The United Nations Economic Commission for Europe (UNECE) staff has circumscribed autonomy due to the limited financial resources of the institution. The staff is limited to supporting individual meetings and travel; it lacks time or money to initiate additional activities. It has worked with some European NGOs in publicizing reports of forest dieback and works closely with the International Institute of Applied Systems Research (IIASA) in applying the Regional Acidification Information and Simulation (RAINS) model to developing regulatory controls. While the European Monitoring and Evaluation Program (EMEP) Trust Fund established by the 1984 Protocol provides important autonomous funding for atmospheric monitoring and modeling activities, the work on monitoring of effects (on freshwaters, forests, materials, ecosystems, and crops), critical loads, and mapping has depended on voluntary national funding.

Institutions as Teachers

Institutions vary in their capacity to foster social learning by groups participating in the institution. Ultimately, innovative ideas are adopted by other actors for their own reasons, through their own methods. Thus, institutions' ability to diffuse lessons is largely a consequence of their ability to influence other actors' willingness to change their behavior and the capacity of these actors to absorb lessons.

Institutions that foster learning exhibit different features than do institutions that learn themselves. To foster learning, institutions must be capable of working directly with national figures in the field as well as providing financial resources to enable others to apply the lessons, or to reward them for doing so. The UNEP, the Global Environmental Facility (GEF), and the UNECE (in conjunction with IIASA) have been some of the most effective institutions in this regard, because they have the financial, technical, or intellectual resources that enable them to influence other actors.

Institutional Properties That Favor Policy Teaching

A lack of institutional legitimacy will hinder the acceptance of new information from an institution. Few results diffused to LDCs, because many LDCs were suspicious of the IPCC and unable to independently appraise its findings

The UNEP's strength is its ability to work with counterparts, both national groups and other international institutions, in countries where the innovations may be adopted, and to work with NGOs and firms who may also wish to adopt innovations. The UNEP also has a proactive engagement with NGOs, providing funding to permit their participation in UNEP assessments and program development. Lack of resources can inhibit the spread of ideas between institutions. The UNEP had little success in catalyzing the WMO to undertake more comprehensive activities in climate change, despite the joint sponsorship of the World Climate Impact Studies Program (WCIP) and Background Air Pollution Monitoring Network (BAPMoN) climate monitoring activities. The WMO approached the climate issues with the same organizational routines with which it addressed weather. It was resistant to the interdisciplinary features of the issues, which were inconsistent with its organizational mission. The UNEP lacked the financial clout to be able to dictate to the WMO, and the WMO was relatively

immune or impervious to information provided by the UNEP because the WMO depended almost exclusively on information from the ICSU and from its constituent Meteorological Services. The GEF's primary resource is its ability to financially reward governments and firms who are willing to embrace its policy innovations.

Functional Activities That Encourage Diffusion of Policy Lessons

In addition to encouraging the dissemination of innovations to other actors, institutions also perform a number of functions that build national capacity to learn. International organizations can set the agenda for members, distribute information, build national monitoring and research capacity, assist industry and societal groups identify new practices that contribute to effective environmental management, train and assist governments to enforce international commitments, structure bargaining fora, and empower new national and transnational political coalitions. Many institutional activities contribute to several of these effects, and the effects are also interactive in their influence on governments and other actors to modify or change their practices.

Sponsorship of international meetings is a primary technique in performing these functions. In addition to international institutions, environmental NGOs were active in this regard. International meetings can forge a policy-relevant scientific consensus, setting the agenda for states or other societal actors; this was the case with Wurzburg regarding the use of ozone depletion potential (ODP) and Villach regarding the magnitude and likelihood of climate change. They can also encourage research coordination and national institution building. The WMO established the WCP to coordinate national research regarding climate variability and change, and the UNEP sponsored international ozone assessments. An important effect of the WCP was the creation of national climate programs in states that had previously lacked this infrastructure.

International meetings spread new scientific knowledge among meeting participants and subsequently to their home states, and they publicize information that can increase public and national government concern regarding an environmental risk. Ozone information generated by the UNEP was used by Greenpeace in Germany to pressure its own government. The Toronto conference had these effects on public opinion and national government activity in the climate change case.

International meetings also provide national governments with a source of scientific information. Rather than rely on the scientific expertise of a single state, states that lack indigenous scientific expertise often look to international sources. Developing states often accept scientific expertise that stems from international institutions more readily than that from an individual metropole. Even states with significant capacity utilize the results of international efforts. For example, Germany's Enquete panel used the IPCC sea-level rise estimates and impact assessments, and used the Villach workshop's and Villach Group's temperature change estimates in making its recommendations (Jager & Cavendar, 1992, pp. 12-18). In the United States, the 1991 National Academy of Sciences (NAS) Effects Panel used the scientific results of the IPCC to bolster the authoritative legitimacy of its report (Dickson & Clark, 1993, pp. 21-22). The Long-Range Transboundary Air Pollution Convention for Europe (LRTAP) forest surveys also heightened regional concern about forest dieback.

Financial assistance to developing states builds national capacity to implement environmental management strategies. Financial support for ozone is

provided primarily through the Montreal Ozone Fund (MOF), while climate change is provided primarily through the GEF. Other international institutions—particularly the United Nations Development Program (UNDP) and the World Bank—are involved with supporting developing states' overall environmental management capacity, through training, purchase of equipment, and funding projects that will reduce emissions. Although it had limited resources itself, the UNEP was very effective at enlisting the support of these larger, better-funded institutions in an effort to spread innovative practices, particularly for mobilizing funding to seek commercial alternatives to chlorofluorocarbons (CFCs).

The UNEP's Industry Environment Program Activity Center (IE/PAC) conducts seminars and workshops on energy efficiency to assist industry to respond to climate change (United Nations Environment Program/International Petroleum Industry Environmental and Conservation Association, 1991). Participation in UNEP and WMO global research and monitoring programs has the ancillary effect of building low levels of indigenous scientific capacity. The UNEP's OzonAction Programme sponsors country programs to assist developing states establish baseline surveys and prepare CFC replacement and control strategies. It also publishes a series of technical publications designed to assist developing states comply with the Protocol. The Industry and Environment Program Activity Center in Paris alerts firms to opportunities for improving energy efficiency and helps developing country officials to establish baseline surveys of CFC use and to prepare strategies for controlling and replacing CFC use. The UNEP thus helps relatively inefficient companies to improve their performance, as well as allowing more efficient manufacturers of energy-efficient technology to expand their markets.

International organizations can stimulate the spread of innovative ideas during state bargaining by playing leadership roles. For example, in the ozone case, the UNEP convened the Wurzburg meeting to develop a scientific consensus regarding ODPs. It then channeled this concept into the bargaining forum that it was sponsoring, facilitating agreement on control measures. Conversely, an innovative bargaining proposal, such as pledge and review in the climate change case, may fail to take root in the absence of an independent, third-party initiative, especially given the ease with which both governmental and nongovernmental actors can kill or maim new initiatives before their possibilities can be developed.

Monitoring and research projects in member countries can also build receptivity for social learning. The governments will be more prone to accept new ideas that accompany activities they value, such as training activities and technology transfer, as well as the prestige that accompanies such activities. National participants in such activities tend to become advocates of the ideas with which such activities are associated, and thus contribute to transnational social learning. The use of local researchers in coordinated international activities is critical. Thus, institutions with significant local counterparts are more likely to encourage learning by doing in member countries. For instance, the WMO, the IPCC, and the IIASA all contributed to weaker countries' (eastern Europe, some LDCs) ability to independently assess computer models developed elsewhere. Institutions can also accord publicity to scientists' views and thus help to set the overall international agenda. The UNEP did this in ozone by convening the 1977 experts meeting and attracting attention to the Rowland-Molina hypothesis. The hypothesis was also legitimized by its recognition by an authoritative group such as the UNEP.

Institutional activities may provide impetus for indigenous learning through socialization in member countries, or among actor groups in those countries. As a consequence of capacity-building activities by institutions, groups in society have an enhanced chance to learn and to disseminate their own lessons throughout their country. Capacity-building exercises, such as joint monitoring and training exercises, can contribute to learning by doing, as other actor groups gain knowledge from new experiences resulting from obligations entailed from the institution. Enhancing domestic capacities may enable countries to learn that otherwise were unable. For instance, the UNEP training programs and the IPCC Third World outreach efforts provide information and training in information processing. Risk assessment and risk management functional capacities are also enhanced by IOs, although not significantly. By improving the cooperative environment, the potential for disseminating lessons abroad is enhanced. By building concern, governments become more sensitive to lessons propounded by members of their society.

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Notes

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[1] In one collaborative work by the UNEP and the IIASA for the World Climate Impact Programme assessing the vulnerability of food production to climate change was adopted in the IPCC WG2's 1990 Impacts Assessment chapter on agriculture because its author served as a consultant to WG2 (Parry, Carter, & Konijn, 1985, pp. 4-5, 43; Parry, 1990). The widespread use of the framework convention/protocol sequence is another exception, and this is due to internal communications in the UNEP and also the UNEP's demonstration effect for the INC and the UNECE. This sequence was first proposed for ozone protection at a UNEP meeting of legal experts in Montevideo in 1981 as a result of its success in UNEP's regional seas program and was subsequently adopted in the climate change case as well. However, the diffusion of the convention/protocol sequence and the ODP-GWP concept are cases of adaptation rather than learning, as we defined them above. The critical loads, tolerable rates, and chlorine peak concepts are instances of learning, in that they all entail a reconceptualization of the risk and new goals. Learning has diffused much less frequently than adaptation, due in part to the barrier of institutional inertia, as well as the idiosyncrasies of the issues and political opposition.

[2] For example, despite Pier Vellinga's efforts, the Villach Group's tolerable rates innovation, which based analysis of response options on environmental targets, was excluded by IPCC WG3 as a basis for the formation of emission scenarios, as its effects-based logic ran counter to the IPCC's cost-based assessment of strategies. Few examples exist of developments in one institution in one issue that were successfully adopted elsewhere. The ODP concept was adopted by the IPCC in its formulation of Global Warming Potentials (GWPs), but it was eventually found technically inadequate for the climate change case.

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